These papers being intended for the use of every class of the community which is either now, or may hereafter be, subjected to the inconvenience and annoyance attendant upon "smoky chimneys," as well as for those more immediately engaged in the business of arranging, constructing, or "curing" chimneys,—for the non-practical as well as for the practical man,—I will studiously avoid entering further into scientific detail than is barely necessary to convey such a correct impression of the principles involved, as may possibly conduce to the removal of this truly popular "fireside" grievance, the "smoky chimney."

If proof of the lamentable ignorance prevailing upon this subject be in any instance necessary, let the sceptic take a ramble through the streets of "this vast metropolis," and scarcely will he find a single dwelling, where the means of the occupant have enabled him to employ the "chimney doctor," that does not present monuments of it, in the shape of chimney tops of every variety of material, form, size, and construction.

A better state of things may be produced by placing the true causes of the imperfect action of chimneys with the means of preventing such imperfections before the notice of all interested in such matters, in a simple, clear, intelligible, and comprehensive manner; and with such intent, I will first endeavour to elucidate the nature and principles of the action of chimneys: I will then describe the causes of imperfect action; and, finally, the means of ensuring proper action; which are based upon the scientific theory of the question, and have stood the practical test that a long and intimate acquaintance with the subject has enabled me to apply. With these prefatory remarks, I will at once introduce my readers to the consideration of the first branch of the subject, in entering upon which we come first to inquire—What office does a chimney perform? The obvious reply is, that of conveying smoke from the firegrate or furnace into the atmosphere. That it performs this office is a fact requiring no argument to demonstrate; but how, or by what means it performs it, is a question not so easily disposed of.

Before proceeding further, let us see of what the atmosphere consists; for, as the smoke from fires is conveyed into, and, as we see daily, ascends through, it, there must be something in its nature and relation to smoke that connects it with the action of chimneys. First, then, as to its nature. The atmosphere is the volume of air which envelopes the earth, and is present at every point of its surface, extending upwards into the firmament to an indefinite distance. It is the air we breathe, and which is necessary to the support of animal life. It is composed of two kinds of gas, viz.,—oxygen gas and nitrogen gas; and in common with all other gases and æriform bodies it is called a fluid.

It is important that the term *fluid* be thoroughly understood, and its meaning remembered, as it will occur frequently in the consideration of our subject. Water, oil, and all other material substances, the particles of which, in their natural state, possess the property of flowing freely among each other (excepting those that are granular, such as sand, flour, corn, &c.), are called fluids. To use a more homely form of explanation, all substances that flow, or can be poured from one vessel to another (excepting granular substances) are fluids.

Smoke is a fluid, and, like the atmosphere, which is also a fluid, it is composed of gases. Hence, we find that a very close relationship exists between the atmosphere and the smoke which ascends into it; inasmuch as they both belong to the same class of natural substances, viz., fluids. Having traced this relationship so far, let us now inquire why the smoke from fires ascends into the atmosphere.

The science of chemistry has revealed to us that atmospheric air is composed of about 80 parts of nitrogen and 20 parts of oxygen gas; and that its specific gravity, or weight, bulk for bulk, compared with pure water, is nearly as 1 to 800, *i. e.* a gallon of atmospheric air is 800 times lighter than a gallon of pure water. The smoke created by burning coal is chiefly composed of carburetted hydrogen gas, which, when purified, or separated as far as possible from other gases, is the same as that commonly used for inflating balloons. Its specific gravity, or weight, as it is evolved from the coal, without being purified, is, compared with pure water, nearly as 1 to 1,600, or about 1,600 times lighter than the water. It is, therefore, compared with common atmospheric air, nearly as 1 to 2; or, in other words, the atmosphere is about twice as heavy, bulk for bulk, as the smoke from burning coal. Here, then, we have smoke a light fluid, and the atmosphere a heavy one, as compared with each other.

Now oil, which is a lighter fluid than water, immersed in a vessel containing water, and liberated near the bottom of the vessel will rise to the surface, just as common air rises in bubbles to the surface of water; and so it is with all fluids that differ with each other in specific gravity, or weight, bulk for bulk. The lighter fluid will ascend through the heavier, until it is stopped by meeting with a lighter fluid than itself; as oil rises through water to its surface, where it is stopped by the atmosphere, which is a lighter fluid than oil; or, until the lighter fluid becomes absorbed or mixed up with the heavier, where the nature of the two will admit of it, as alcoholic spirits and water.

This phenomenon may be illustrated by the following experiments:—Let AB, fig. 1, represent an ordinary scale-beam, evenly poised upon its fulcrum C, and supporting at its two extremities two vessels *a b* of exactly similar dimensions and weight; and let the beam AB be prevented from moving until required. Now fill the vessel *a* with a heavy fluid, say mercury, or "quicksilver," and the vessel *b* with a lighter fluid, as water: mercury being about fourteen times heavier than water, bulk for bulk, the vessel *a* will press downward with fourteen times as much force as that of the vessel *b*. Release the beam AB, and the end supporting the vessel *a* will instantly fall, and the superior pressure from the heavy fluid contained in *a* being communicated to the lighter fluid in *b*, through the medium of the beam AB, the latter will rise, and continue to do so until stopped by the limit to the travel of the beam AB.

Fig. 1.

Again: Let AB, fig. 2, represent a bended tube, open at the two ends, and having a stop-cock in the centre, at C. Let the stop-cock be closed; the leg A of the tube AB filled with mercury to the level of the line *a b*; and the leg B with water to the same level. So long as the stop-cock at C remains closed, and the particles of the two columns of fluid thereby prevented from communicating with each other, the surface of each column of fluid will continue to stand at the same level, *a b*, and a perfect balance will be maintained. But, upon opening the stop-cock, C, the two columns will instantly come into contact at the point *e*, and the mercury, being the heavier fluid, will force the column of water up the leg B until the surface reaches the point *d*, fig. 3. At the same time, the surface of the mercury at *a*, fig. 2, will fall to the point *e*, fig. 3, and the point of contact between the two columns will be at *g*, fig. 3, instead of at *e*, as at first. The difference of level between the surface of the mercury at *e*, and the new point of contact at *g*, is occasioned by the pressure of the column of water at *g*, proving that the column of mercury, *e f*, is equal to the column of water *d g*, which, upon measurement, will be found to be about fourteen times the length of *e f*. It matters not what fluids are used in these experiments, the same results will follow, but in different proportions.

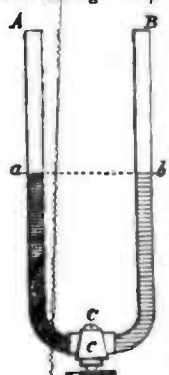

Fig. 2.

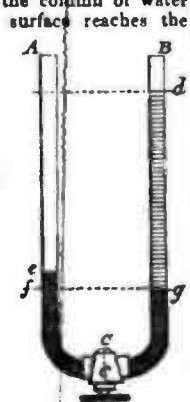

Fig. 3.

Now, in order to show how the same principle operates to cause one fluid to rise through another, let ABCD, fig. 4, represent a vessel filled with water to the level of the line *a b*: divide the volume of water into columns by imaginary lines *e d* and *e f*, which being all of the same depth, substance, and weight, will equally balance each other. Now, suppose a body of air introduced into the centre, or middle column, near its base, as at *g*; as air is lighter than water, it follows that the centre column, containing the air *g*, must be as much lighter than the surrounding columns as the body of air *g* is lighter than the same bulk of water. The centre column, then, being rendered lighter than the surrounding ones by the presence of the air *g*, the balance before existing is destroyed, and the central column below *g*, being pressed by a greater weight than itself, will rise; or, what amounts to the same thing, will make way for the air *g* to rise until it reaches the surface; the particles composing the column being moved aside by the ascending body *g*, in the same way as the water is moved aside by the bows of a ship to admit of her progress through it. As in the former experiments, it matters not what fluids are used, the same result will follow. If, then, we suppose the fluid contained in the vessel ABCD to be atmospheric air, and *g* a volume of coal smoke, we shall have obtained a perfectly clear demonstration of the cause, or reason "why the smoke from fires ascends into the atmosphere."

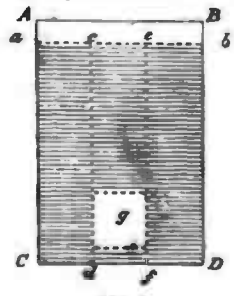

Fig. 4.

Every one knows, from personal observation, that smoke rises; but it is not so generally known that it does so because it is only one-half the specific gravity or weight, bulk for bulk, of the atmosphere; and therefore that it is forced upward by the pressure of the atmosphere beneath it. The cause of the ascending motion of fluids through each other, then, is gravity or weight; and the consideration of the laws which govern its action upon fluids belongs to that branch of physical science called Hydrostatics; a term which is derived from two Greek words signifying "water," and "standing" or "settling."

TBA.

THE DESOLATION OF WINDSOR.

THE Royal Borough of Windsor is just now one of the most ragged towns in the British empire, Ireland not excepted. The readers of THE BUILDER no doubt remember, that some years since a scheme was propounded and put in hand by the Board of Works for the "Improvement of the Town and Castle of Windsor," including considerable alterations in the approaches from the pretty little village of Datchet on the north side, and from Old Windsor on the east; and in aid of this scheme considerable sums of money were *extracted* from the rival railways which have the honour of conveying her Majesty and her Majesty's lieges to and from the Royal Borough. In carrying out these plans two new bridges are required to be thrown across the Thames in lieu of the present semi-ancient (one half is wood, and one-half iron, to which there hangs a tale which must not be told at present) bridge at Datchet, in order to direct the traffic round instead of through the Home Park. To facilitate the work, and no doubt directed by a wise economy, these bridges are both of the same design, and being of iron, are cast from the same patterns; but when they are to be finished is far beyond the knowledge of any one here. Nobody remembers when the foundations were commenced, and the fact that it has taken the whole of this summer to get parts of three ribs to one bridge and a portion of two ribs to the other fixed, renders all calcu-

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